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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/885,046

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Naoki Shibata

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 06/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/885,046

Applicant(s)

SHIBATA ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7, 32 and 33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 32 and 33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-7, 32 and 33 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The feature that the recited undercoat layer is doped with Mg at a concentration no smaller than $10^{20}/\text{cm}^3$ and the truncated hexagonal pyramid patterns are formed through annealing the Mg-doped undercoat without the using of any masks are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). As admitted in the specification, these features are critical to the formation of the recited truncated hexagonal pyramid patterns (see the specification, particularly see page 14, line 18, through page 15, line 9).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5, 32 and 33, insofar as being in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(b) as being anticipated by Sunakawa et al. ("Sunakawa"; Japan 10-312971; of record).

Sunakawa discloses a Group-III nitride compound semiconductor device (Figs. 1, 3 and 6, especially Fig. 3; also see the English translation regarding Figs. 5 and 7 in US Patent 6,348,096, which is based on Japan 10-312971), comprising: a substrate (21); an undercoat layer (GaN; including layer 22 and a lower portion of layer 25; see Fig. 3(a)); and group-III semiconductor layers (including an upper portion of layer 25, and layers 66-68 and 70-73) overlying the undercoat layer; wherein the undercoat layer having a surface with convex portions each shaped substantially like a truncated hexagonal pyramid (see Figs. 3(a)-3(c)).

Regarding claim 5, the substrate in Sunakawa can be Al_2O_3 (which is often a synonym of sapphire in the art) or SiC (see Sections 0036 and 0085; or see col.5, lines 16-22 in US Patent 6,348,096).

Regarding claim 7, the GaN layers in Sunakawa have a function of a light-emitting device.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sunakawa et al. ("Sunakawa"; 10-312971) in view of Kern et al. ("Kern"; 6,194,742).

The disclosure of Sunakawa is discussed as applied to claims 1, 5 and 7 above.

Sunakawa does not disclose that the GaN undercoat layer can be doped with Mg. However, Kern teaches to form a GaN-base light-emitting device (Fig. 3; also see col. 3, lines 6-22, and lines 66-67), comprising a Mg-doped GaN undercoat layer,(16), for increasing device reliability and reproducibility.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor device of Sunakawa with the undercoat layer being doped with Mg, so that a semiconductor light-emitting device with increased device reliability and reproducibility would be achieved, per the teachings of Kern.

Regarding claim 3, the Mg concentration in the undercoat layer in Kern can be up to $5 \times 10^{21} \text{cm}^{-3}$ (see col. 4, line 52-53).

Regarding claim 6, although Sunakawa does not expressly disclose that the device can further comprise a sedimentary layer between the substrate and the undercoat layer, Kern further teaches to include such a sedimentary layer (14) in the GaN-based light-emitting device. It would therefore have been

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obvious to one of ordinary skill in the art at the time the invention was made to further incorporate the sedimentary layer of Kern into the device of Sunakawa for improving the quality of the epitaxially grown GaN layers.

Allowable Subject Matter

5. Claim 4 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, first paragraph, set forth in this Office action.

6. The following is a statement of reasons for the indication of allowable subject matter: Prior art does not teach or render obvious a Group-III nitride compound semiconductor device, comprising a Mg-doped GaN undercoat layer, wherein the undercoat layer having a surface with convex portions each shaped like a truncated hexagonal pyramid; and the undercoat layer is also doped with an n-type dopant and is of an n-type overall.

Response to Arguments

7. Applicant's arguments filed on July 29, 2002 have been fully considered but they are not persuasive.

Applicant's main arguments include: the applied prior art reference of Sunakawa does not teach the claimed invention of the instant application, because Sunakawa fails to disclose the undercoat layer as recited in the claimed invention. These arguments are not persuasive. According to Random House Webster's college dictionary, the word of "undercoat" may have broad meanings, including: (1) a coat or jacket worn under another; (2) a growth of short fur or hair

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lying beneath a longer growth; (3) an undercoating; and (4) a paint, sealer, or the like specially prepared for use underneath a finishing coat, or a coat of such paint or sealer applied under the finishing coat. In addition, the term of a "truncated hexagonal pyramid" can be interpreted as a hexagonal pyramid being truncated either from its top or from its bottom. And, as shown in Figs. 3(a)-3(d) in Sunakawa, layer 22 and a lower portion of layer 25 (see Fig. 3(a) can be regarded as an undercoat layer as they each are formed of GaN and they together undercoat the later-formed upper flat portion of the GaN layer 25 and decreases dislocations in the upper flat portion of the GaN layer 25. And, the upper portion of the GaN layer 25 has a substantially flat surface (see Fig. 3(d)), while the lower portion of the GaN layer 25 has a surface with convex portions each shaped substantially like a truncated hexagonal pyramid (see Figs. 3(a)-3(c)). Each of the convex portions in the lower portion of the GaN 25 has a shape substantially like a truncated hexagonal pyramid as it has a bottom surface that is substantially flat, and a top surface that is also substantially flat at least during the early stage of the epitaxial growth of the lower portion of the GaN layer 25 (when its thickness is still much thinner than that of the mask layer (23)); and the top surface of the lower portion of the GaN again becomes more and more flattened after its thickness becomes substantially thicker than that of the mask layer (23).

Applicant is reminded that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Since

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the term of "an undercoat layer" can have broad meanings, if applicant believes that the undercoat layer in the instant invention has different feature(s) compared with that of the undercoat layer in Sunakawa, such different feature(s) should be clearly defined in the claims in order to overcome the relevant claim rejections.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH
June 15, 2003


Shouxiang Hu
Patent Examiner
TC2800